



DC Water Environmental Impact Bond

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I. Executive Summary

In October 2016, the DC Water and Sewer Authority (DC Water) launched an Environmental Impact Bond (EIB) to finance the installation of 20 equivalent impervious acres of green infrastructure in the Rock Creek sewershed of the District of Columbia. With the goal of managing stormwater runoff using a green solution, this project contributes to DC Water’s Combined Sewer Overflow reduction program.

The DC Water EIB breaks important new ground for the pay for success (PFS) field. The project represents the first *environmental* pay for success project – as it applied a PFS approach to green stormwater infrastructure. Unlike typical PFS projects, the DC Water project used an innovative municipal bond to raise financing. In addition, the DC Water EIB is one of the largest PFS projects in the world - with a total private investment of \$25 million.

Beyond the PFS field, the DC Water project represents an innovation for environmentally friendly investments in general. Often, green investments are in the form of conventional government bonds; the only thing that makes them green are that they are financing green projects. The DC Water project creates a green investment with a payout that varies depending on the level of environmental benefits accrued. This novel component of the project, with built in incentives for greater environmental impact, has the potential to be a model for future green investments.

This policy brief discusses the DC Water project components in-depth, and offers lessons learned for the future.

Background

Every year, the DC Water and Sewer Authority sends over two billion gallons of combined sewer overflows – a combination of wastewater and stormwater – into the Potomac River, Anacostia River, and Rock Creek tributaries.¹ Combined Sewer Overflows (CSOs) occur in areas with a combined sewer system, where the same pipes that carry waste water

DC Water EIB: Fast Facts

- Problem: Combined Sewer Overflows (CSOs)
- Solution: Green infrastructure – permeable pavement and bioretention
- Neighborhood: Rock Creek sewershed
- Timeline: 5 years
- Major project milestones:
 - Contract signed: Winter 2017
 - Construction Completion: Spring 2019
 - Post-Construction Monitoring Completion: Spring 2020
 - Mandatory Tender Date: Spring 2021
- Outcome: Percentage reduction in stormwater runoff per acre
- Size: \$25 million
- Evaluation: Pre-to-post analysis
- Project Partners: DC Water and Sewer Authority, Goldman Sachs Urban Investment Group, Calvert Foundation, Public Financial Management, Squire Patton Boggs, Orrick, Herrington & Sutcliffe LLP, Quantified Ventures, Harvard Kennedy School Government Performance Lab
- Contributions to the Field: First environmental PFS project, use of municipal bond, one of the largest PFS projects

from homes and businesses also carry stormwater when it rains. (In a separated system, two separate pipe systems carry waste water and stormwater). In a combined system, if the rainfall entering the sewer system exceeds the system’s capacity, the system is designed to overflow into nearby water ways, rather than backing up into homes and businesses. This stormwater/waste water overflow can damage the water quality of rivers, creeks, and tributaries, namely by increasing the amount of nitrogen and phosphorous in the water, the delicate balance of which is critical to maintaining healthy levels of fish and wildlife.² In response, many cities and water authorities with combined sewer systems have entered into legal agreements with State and/or Federal Environmental Protection Agencies to reduce CSOs and in turn, improve water quality.

¹<https://www.dewater.com/whats-going-on/news/dc-water-awarded-grant-harvard-university-develop-innovative-green>

²<https://www3.epa.gov/region02/water/sewer-report-3-2011.pdf>

In 2005, DC Water entered into its Consent Decree with the U.S. Department of Justice, U.S. Environmental Protection Agency, and the District of Columbia to mitigate CSOs. Initially, the Consent Decree called for an entirely gray infrastructure solution focused on deep water tunnels to mitigate CSOs. In 2015, DC Water re-negotiated its Consent Decree to incorporate green infrastructure.³ The green infrastructure portion of the Consent Decree outlines a series of green infrastructure projects to manage CSOs in two sewersheds, the Rock Creek sewershed and the Potomac River sewershed.⁴ In the Rock Creek sewershed, the Consent Decree calls for five sequential green infrastructure projects. According to the Consent Decree, after installing the first green infrastructure project, DC Water must assess the practicability (including cost, effectiveness, ease of future green infrastructure construction, etc.) of moving forward with the remaining green infrastructure projects. Should DC Water determine that it is not practicable to move forward, the Consent Decree requires DC Water to develop other solutions to mitigate CSOs and meet the CSO reduction requirements of the Consent Decree.

In response to the Consent Decree requirement to install the first green infrastructure project and measure its effectiveness, DC Water assembled a team to consider the possibility of using a PFS approach to finance the project.

Pay for Success

Pay for success projects, also called Social Impact Bonds, have traditionally been used to fund the expansion of social services (like early childhood education, permanent supported housing, and infant and maternal health programs). PFS projects typically combine nonprofit expertise, private sector funding, and rigorous measurement and evaluation to transform the way government and society respond to chronic social problems. Private funders provide upfront capital to expand social services, and the government pays for the program only if it measurably improves the lives of participants. In some PFS projects, investors can earn a small return on their investment. The first PFS project was launched in 2010 in Peterborough, England. Since then, there have been over 60 projects launched worldwide.⁵

After nearly two years of development, DC Water officially launched its Environmental Impact Bond (EIB) in October 2016 to fund the construction of 20

equivalent impervious acres of green stormwater infrastructure in the Rock Creek sewershed.⁶ The EIB uses a financial structure that is inspired by PFS, and it is one of the first projects to use the PFS approach to address environmental outcomes. This policy brief discusses the structure of the EIB, how it differs from a traditional PFS project, and lessons learned for future projects.

Goals of the PFS Project

The goals of the Environmental Impact Bond (EIB) include:

- *Provide a green solution to stormwater runoff and CSOs in the Rock Creek sewershed in the District of Columbia:* This project is the first project in DC Water's green infrastructure program as part of its CSO reduction program, the DC Clean Rivers Project. More broadly, this project also expands the number of green infrastructure installations in the District.
- *Contribute to the research on green infrastructure's effectiveness through rigorous evaluation:* Several other cities have evaluated the effectiveness of green infrastructure; however, these evaluations have tended to be of smaller green infrastructure installations (less than or equal to one equivalent impervious acre⁷). This evaluation will measure the effectiveness of 20 equivalent impervious acres and contribute to the overall body of research on green infrastructure.
- *Offer an alternative financing solution for future PFS projects:* All other PFS projects in the United States have been financed through an operating loan. This project is financed through a municipal bond, privately placed, which could offer an alternative financing option for future PFS projects.

II. Intervention

Green infrastructure is an umbrella term that refers to a set of interventions that includes bioretention (also called bioswales or rain gardens), permeable pavements, green roofs, and rain barrels. Each of these practices is designed to mimic the same absorption and filtering processes found in nature in order to slow surges of stormwater during periods of heavy rainfall. Beneath the surface of a rain garden or permeable pavement installation, there are layers

⁶ <https://www.dewater.com/whats-going-on/news/dc-water-goldman-sachs-and-calvert-foundation-pioneer-environmental-impact-bond>

⁷ An important note on terminology: One equivalent impervious acre of green infrastructure does not mean that the green infrastructure installed is one acre in size but instead indicates that the green infrastructure installed is designed to manage the equivalent of one acre of storm water as converted from cubic feet.

³ <https://www.dewater.com/green-infrastructure>

⁴ <https://www.dewater.com/sites/default/files/green-infrastructure-ltcp-modifications.pdf>

⁵ http://www.socialfinance.org.uk/wp-content/uploads/2016/07/SIBs-Early-Years_Social-Finance_2016_Final3.pdf

of soil, rock, and gravel that slowly filter stormwater allowing it to be reabsorbed into the ground or flow into the sewer system and back to the treatment facility for treatment. By absorbing and slowing stormwater, green infrastructure mitigates stormwater runoff, ultimately reducing the incidence and volume of CSOs.

There is a large body of research supporting green infrastructure's effectiveness in reducing stormwater runoff. Many other jurisdictions including New York City, San Francisco, and Portland, have publicly released the results of their green infrastructure monitoring programs indicating successful installations that effectively reduce stormwater runoff.⁸ Furthermore, academic studies, like the research conducted by University of New Hampshire's Stormwater Center indicate that green infrastructure is effective at reducing stormwater runoff.⁹

In the project funded by the EIB, DC Water will construct 20 equivalent impervious acres of green stormwater infrastructure. The green infrastructure practices included in this project are permeable pavement in the parking lane and alleyways, planter bioretention, and curb extension bioretention. A design-build firm, contracted by DC Water, will complete the final design and installation as outlined in design plans developed by DC Water and its contractors.

III. Details of PFS Contract

Timeline

The timeline of this project is a roughly 5 years, with one year of pre-construction monitoring, two years of construction, one year of post-construction monitoring, and six to nine months of evaluation synthesis.

Evaluation

DC Water is conducting a rigorous, three-step evaluation of its first green infrastructure project. The outcome of interest is the percentage reduction in stormwater runoff per acre.

- First, DC Water conducted pre-construction monitoring. DC Water installed flow meters in strategic locations in the sewer lines under the specific neighborhood where the first green infrastructure project will be installed. These flow meters measure stormwater runoff prior to

the installation of green infrastructure. DC Water also installed a rain gauge in the neighborhood to gather site specific rainfall data that will be compared to the data gathered by the rain gauge already installed at Ronald Reagan International Airport. The rain gauge data will also be used to account for differences in rainfall between measurement years.

- Second, DC Water predicted the expected percentage reduction in stormwater runoff per acre. By combining the results from the pre-construction monitoring and the design plan for the first green infrastructure project in the Rock Creek sewershed, DC Water modeled the expected percentage reduction in stormwater runoff per acre, meaning that this green infrastructure project is expected to reduce stormwater runoff per acre anywhere from 18.6% to 41.3%. A percentage reduction larger than the top of this range (a 41.3% reduction) would qualify as a better than expected result. A percentage reduction smaller than the bottom of this range (a 18.6% reduction) would qualify as a worse than expected result. An independent engineering firm selected by the investors confirmed this range.
- Third, once green infrastructure installation is complete, DC Water will conduct post-construction monitoring in the same manner as it conducted the pre-construction monitoring.

By comparing the post-construction stormwater runoff to the pre-construction stormwater runoff, DC Water will calculate the percentage reduction in stormwater runoff per acre. An independent validator will confirm the results of the evaluation.

Payable Outcomes and Financing Structure

Unlike other PFS projects, DC Water's EIB is a true municipal bond, privately placed with Goldman Sachs Urban Investment Group and Calvert Foundation, rather than an operating loan. Throughout the term of the bond, investors will receive a semi-annual coupon payment, of 3.43%. At the mandatory tender date (slightly less than 5 years after project launch), investors will receive a contingent payment based on the effectiveness of green infrastructure in reducing stormwater runoff. Payment at the mandatory tender date will follow the performance tiers described below:

- **Tier 1: Better than Expected**
Runoff Reduction > 41.3%
Investors will receive an additional Outcome Payment of \$3.3 million.
- **Tier 2: Expected**
Runoff reduction between 18.6% and 41.3%
No contingent payment to investors due.
- **Tier 3: Worse than Expected**

⁸NYC: http://www.nyc.gov/html/dep/pdf/cso_long_term_control_plan/post-construction-monitoring-report-gi-neighborhood-demonstration-areas.pdf SF:

<http://sfwater.org/index.aspx?page=667> Portland: <https://www.portlandoregon.gov/bes/article/432507>

⁹ <https://www.unh.edu/unhsc/>

Runoff Reduction < 18.6%
Investors owe a Risk Share Payment to DC
Water of \$3.3 million.

Project Partners

The DC Water and Sewer Authority spearheaded this project and gathered project partners. Goldman Sachs and Calvert Foundation were investors on the project. Squire Patton Boggs and Orrick, Herrington & Sutcliffe LLP served as legal counsel for DC Water and the investors, respectively. PFM served as financial advisor for DC Water. Quantified Ventures served as the PFS transaction coordinator. The Harvard Kennedy School Government Performance Lab served as the government-side technical advisor. DC Water will carry out the evaluation, and an independent validator, to be selected, will confirm the evaluation.

IV. Lessons Learned

Lesson Learned #1: A Pay for Success project can be financed with a true municipal bond, in lieu of an operating loan. While this reduced some transaction costs relative to other PFS projects, the innovative features of this project meant that it still required 18 months to assemble.

By electing to use a municipal bond as its financing mechanism, DC Water relied on many of the same structures and processes that it typically does in a municipal bond financing, including deal documentation. This proved beneficial to the deal as many supporting parties (PFM, Squire Patton Boggs, and Orrick) were familiar with municipal bonds broadly, DC Water's bond issuance process, and standard documents issued with a municipal bond. Initially, the team thought that since the documents and processes of a municipal bond structure are fairly standardized, utilizing this structure would speed up the time to transaction close (as compared to a typical PFS project). However, developing the DC Water EIB project still took close to two years to launch, and the bond documents required customization to accommodate the novel features of the transaction. Furthermore, determining the tax status of the deal (tax-exempt or taxable) also required additional consideration due to the contingent payment aspect of the financial structure (a standard feature of PFS projects, but not of municipal bonds).

The U.S. Treasury issues specific regulations dictating when a municipal bond with a contingent payment can qualify as tax-exempt. One of these regulations specifies that to qualify for tax exemption one of the outcomes (under a contingent payment structure) must be significantly more likely to occur than the other outcomes. Typical repayment structures used in the PFS field where outcomes

payments are made quarterly, semi-annually, and/or annually based on regular evaluations may be challenging to align with the requirements for tax-exempt status. However, the DC Water project was able to qualify as tax-exempt because its repayment structure met U.S. treasury requirements for a bond with a contingent payment (including that one of the outcomes was significantly more likely to occur than the other outcomes). Jurisdictions seeking to use a municipal bond for a PFS project should seek guidance from legal counsel on the topic of tax exemption.

In the future, as more jurisdictions pursue PFS projects broadly and PFS projects utilizing a municipal bond specifically, jurisdictions may experience faster deal development timelines by relying on the standard documents and processes associated with a municipal bond. However, the bespoke nature of PFS projects will likely still require customization of standard documents.

Lesson Learned #2: The risk associated with green infrastructure projects is different from the risk associated with social service projects.

A key feature of PFS projects is risk transfer from the government to investors. By making repayment of the entire loan or a portion of the loan contingent on the effectiveness of the intervention, governments can experiment with new interventions without taking on the risk that they won't be effective.

The risk associated with a PFS project falls into four categories: evidence risk (how well supported is an intervention in the literature?), implementation risk (how likely will an intervention be implemented with fidelity to the model?), evaluation risk (how likely is it that the evaluation will produce an accurate result?), and appropriations risk (how likely is it that the government will be able to re-pay the loan?). Assuming that PFS projects can be structured to mitigate the risk associated with evaluation (by designing a rigorous evaluation with a large enough sample size) and appropriations (by setting up clear timing and processes to appropriate funds through a sinking or set aside fund or the legal mechanism in a municipal bond), the risk associated with the evidence base for the intervention and the implementation of the intervention are the main areas of risk that are transferred from the government to the investors.

In a PFS project targeting a social service, even if the evidence base is strong and the intervention is implemented with fidelity to the model, there is still a chance that those who are served by the intervention, the people involved, could be impacted differently than previous target populations. In green infrastructure projects, where the intervention

does not involve influencing people's behavior but rather involves constructing a physical infrastructure installation, the risk associated with implementation is quite different than a social service intervention.

Given the robust evidence base and clear standards and best practices for green infrastructure design and installation, if a contractor constructs a green infrastructure practice to an accurate design, it is highly likely that the practice will successfully reduce stormwater runoff. Accurately designing and implementing a green infrastructure project is directly connected to the effectiveness of the project. Therefore, the challenge in managing implementation risk for a green infrastructure project is ensuring proper design and construction.

Transferring the implementation risk to the investors involves inviting investors into the design and construction phases, giving investors a voice in the contractor selection process, and may even mean transferring the management of the construction phase of the project to the investors themselves. These services may be particularly valuable for cities or water authorities with limited experience with green infrastructure. Although the DC Water EIB kept implementation responsibility with DC Water, future iterations of PFS projects focused on this issue area may find it beneficial to transfer the implementation risk.

Unless a jurisdiction has another risk they are trying to manage (like DC Water managing the risk associated with having to return to and spend additional money on a grey tunnel solution if the green infrastructure project does not meet expectations), it may not make sense for a jurisdiction to move forward with a PFS project and retain implementation risk. Without transferring implementation risk to the investor, it may not be in a government's best interest to utilize a PFS financing structure, which typically carries a higher interest rate than what a jurisdiction would typically receive if they floated a standard municipal bond. DC Water did achieve a low interest rate on the EIB, comparable to its long-term historic cost of tax-exempt funds (given the market dynamics at the time of issuance), in line with the risk it was sharing with investors.

Lesson Learned #3: There may be an additional opportunity for outcomes-based contracting for green infrastructure maintenance.

Once a green infrastructure practice has been constructed, it must be regularly maintained on a schedule specific to the green infrastructure type installed. Permeable pavements must be swept to ensure that silt and debris do not clog the pavement preventing infiltration of stormwater. Rain gardens

and bioretention cells must be weeded, cleared of trash and debris, and nurtured to encourage growth of the plants and shrubs and prevent clogging. If green infrastructure practices are not maintained, their performance is reduced. The green infrastructure will slowly cease to manage as much stormwater as was intended in its design. Therefore, maintenance is critical for these practices to continue to reduce stormwater runoff and be part of any city's CSO reduction strategy. In the DC Water project, the same contractor that constructed the practices is responsible for maintenance in the first year during the post-construction monitoring period. The measurement of the effectiveness of green infrastructure will occur in the first year of the project. Afterward, DC Water will have to maintain the practices themselves or contract out the maintenance services.

To ensure that these practices are maintained, a performance contract that incentivizes maintenance services that maintain the performance of green infrastructure in managing stormwater runoff may be a distinct opportunity for innovation. The contract could require periodic, perhaps annual, testing of a certain number of green infrastructure practices (the method for this essentially involves dumping a large amount of water on an individual green infrastructure practice at a rate which simulates a specific kind of rain storm). A certain amount of payment to the service provider could be predicated on the continued performance of the practices. This kind of contract might ensure that maintenance practices are done routinely and with the desired impact.

V. Conclusion

DC Water's Environmental Impact Bond to finance 20 equivalent impervious acres of green infrastructure in the Rock Creek sewershed opens the door to a new financing vehicle for PFS projects: a municipal bond with variable payout. The lessons from this project, particularly around the risk associated with environmental projects, can inform other jurisdictions considering an EIB for green infrastructure or other environmental projects.

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